(1) J. Taylor

OPERATING and MAINTENANCE MANUAL No. 9522

JERROLD

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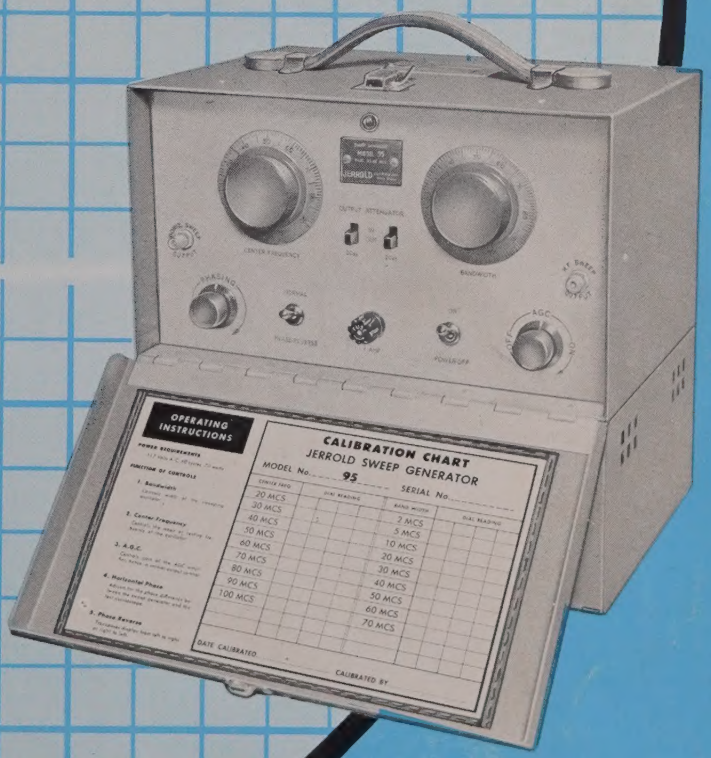
TEST EQUIPMENT
CROSLEY, D... OF AVCO
ITEM 2 COPY 1

SWEEP GENERATOR

Model 95-220



JERROLD ELECTRONICS CORPORATION
23rd & Chestnut Streets · Philadelphia 3, Penna.

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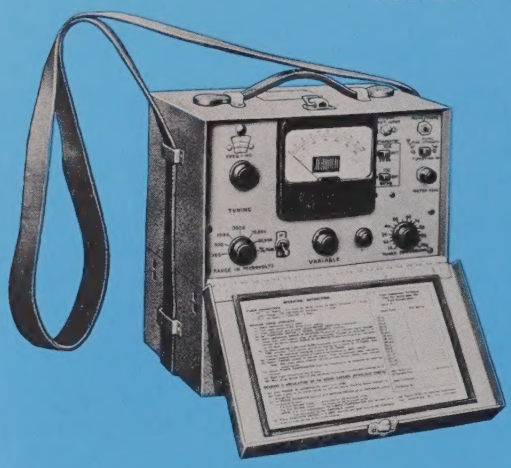
TEST EQUIPMENT and ENGINEERED ACCESSORIES

for improved techniques and control in . . . Production, Equipment Design, Laboratory and Field Research, and RF Transmission.

VHF FIELD STRENGTH METER Model 704B



The Jerrold 704B direct reading field strength meter is a high quality, versatile and portable instrument designed for the accurate measurement of signal strength in the frequency range of 54 to 220 mc. The overall range of the instrument is 5 microvolts to 3 volts with an accuracy of ±0.8 db. The versatility of the Model 704B is illustrated by a partial list of its applications.

FOR USE IN:

Field Intensity Surveys • Checking % AM Distortion of FM Amplifiers • Checking % of Modulation of FM Carriers • Measuring Radiation • Measuring and Locating Interference • Measuring Individual Video and Audio Carrier Levels . . . and many other uses.

OSCILLOSCOPE PRE-AMPLIFIER Model SPR-100

Provides: **Wide Band Detector** (Flat from 100 KC to 250 mc)
Audio Amplifier (Gain—Over 100X)
Marker Injector (With Dual Inputs)

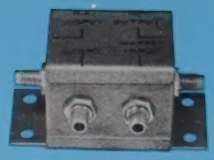
This unusual oscilloscope pre-amplifier features extremely low hum and noise level, excellent stability and 60 cycle square-wave response. Three position switch permits connecting the detector directly to the oscilloscope, through the amplifier with natural response, or through the amplifier with a high-pass response. Marker injector has special filtering to prevent distortion and gain control to adjust height of marker pip. Ideal for use with Jerrold Model 95 or 220 Sweep Generators. 75 ohm impedance.

HIGH SPEED-ELECTRICAL COAXIAL SWITCH Model FD-30

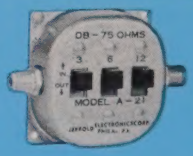
This electronic keyer consists of two coaxially-mounted mercury relays forming SPDT coaxial switches. Special circuitry for driving them at 30 CPS locked, with variable phase to the supply line.

Used with a sweep set-up, the keyer allows precise measurement of gain, loss and impedance match. Frequency response is "flat" from 0 to 220 mc. 75 ohm impedance.

DETECTOR Model D-85

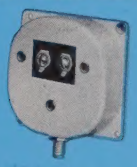


A split type RF detector designed specifically for use with Jerrold Models 95 and 220 sweep generators. Model D-85 utilizes a voltage doubling circuit to permit outputs of up to 1 volt dc. The detector exhibits an output response flat within ±1.0 db over the frequency range of 0.5 to 250 megacycles and is matched to 75 ohms with a VSWR of less than 1.06.



VARIABLE ATTENUATORS Model A-72 and A-21

Switch type, Variable RF Attenuators providing precise attenuation over the frequency range of 0 to 250 megacycles. The units are matched to 75 ohms with a VSWR of less than 1.05 and are capable of handling 500 milliwatts of power. *Model A-72* attenuates from 0 to 82 db. *Model A-21* attenuates from 0 to 21 db.



MATCHING TRANSFORMER Model T-372

Designed for positive impedance match between 75 and 300 ohms with a flat signal response over the entire frequency range of 50 to 250 mc.

ALIGNMENT JIG Model AJ-106

Capacity coupling alignment jig used where an RF signal must be inserted between stages of amplifiers or similar equipment. The AJ-106 is placed over a cold (dummy) tube and the alignment or test signal from the signal generator is connected to the jig.

FIXED RF ATTENUATORS Models PDC and PDL

Attenuator Pads using resistive Pi networks to provide a specified attenuation for use in 75 ohms circuits. Exhibit a VSWR of less than 1.2 to 1 over the range of 0 to 220 mc. The in-line tubular design permits convenient insertion into the coaxial line or direct connection to the equipment chassis. Model PDC is for chassis mounting. Model PDL for in-line mounting.

SOLDERLESS COAXIAL CABLE CONNECTORS "F" Series

MODEL F-59

MODEL F-61

MODEL AF-101

A complete, integrated line of coaxial cable connectors and fittings designed expressly to meet the severest requirements for RF distribution systems, for RF laboratory use, for RF equipment and for general service work. Using only simple hand tools, the Jerrold solderless connectors can be permanently bonded to all types of RG-35, RG-11, RG-59 and RG-6 type cables in just a fraction of the time usually required to make soldered connections. Each Jerrold fitting is carefully machined of brass and is heavily silver plated to maintain low contact resistance through years of service. Shunt capacitance and impedance mismatches are held to extremely low levels—to the extent that their VSWR is less than 1.04 up to 200 megacycles. The "F" series connectors are so designed that the smallest fitting can be mated to any of the standard 75 ohm coaxial cables mentioned above.

JERROLD

JERROLD ELECTRONICS

Section 1 General Description

JERROLD Wide-Band Sweep Generators - Model 95 and Model 220 - are rugged, portable instruments featuring an all electronic sweep circuit; designed for the test and alignment of radio frequency circuits in the VHF Television Band. Their portability, mechanical and electrical stability, and extreme constancy of output recommend these instruments wherever careful and accurate frequency measurements are to be made, on the production test line, in the design laboratory, in the field.....

SWEEP RANGE

Each of the generators contains a radio frequency oscillator which is the primary source of output power. A saturable reactor provides a means of sweeping the frequency of this oscillator from one end of the output band to the other or through any portion of this band - at a 60 cycle sweep rate.

Model 95

The sweep width of the Model 95 Generator is continuously variable from 2 MC to approximately 73 MC. The instrument is particularly useful in the alignment and/or test of R.F. circuitry in the frequency range of 22 MC to 95 MC. This makes it possible for example, to sweep the entire Jerrold "W" and "K" System (24 to 88 MC) without the necessity of changing the generator's center frequency.

Model 220

The sweep width of the Model 220 Generator is continuously variable from 2 MC to approximately 166 MC making it possible to sweep the entire VHF television band (54 to 216 MC) without the necessity of changing the generator's center frequency. The instrument is extremely valuable for the alignment and test of R.F. circuitry in the frequency range of 54 MC to 220 MC.

R. F. OUTPUT

The R.F. output voltage of both instruments is controlled by A.G.C. circuitry which holds the output voltage flat within ± 0.5db across the entire band at any pre-set

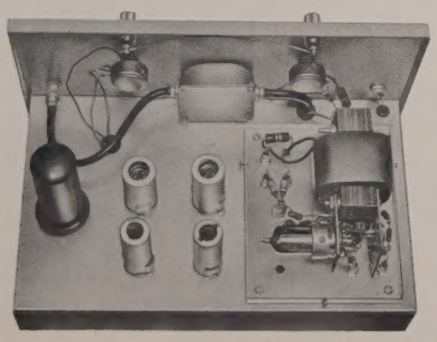


Figure 1

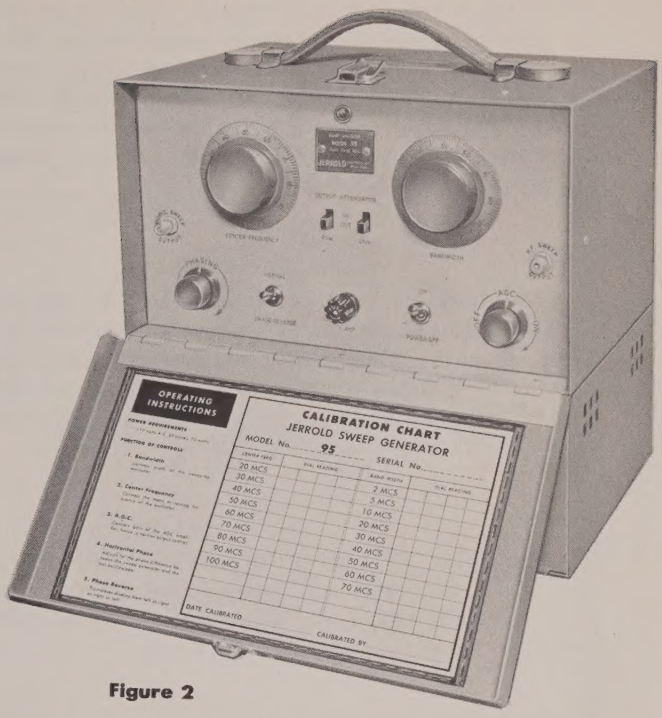


Figure 2

SPECIFICATIONS

FREQUENCY RANGE:
Model 95: 22 to 95 MC/SEC
Model 220: 54 to 220 MC/SEC

SWEEP RANGE:
Approximately 5 to 1.

R. F. OUTPUT RESPONSE:
Model 95: 1.5 Volts flat across an 73 MC band
Model 220: 0.7 Volts flat across an 166 MC band

HORIZONTAL SWEEP OUTPUT
Sine voltage of 60 cps. Complete phasing over a range of 360 degrees is provided.

BLANKING:
Blanking is provided, and accomplished internally.

POWER REQUIREMENTS:
117 Volts a-c, 60 cps at 70 watts

FUSE:
Line, 3AG, 1 amp

TUBE COMPLEMENT:
V-1 - 6BC8 - R.F. Sweep Oscillator
V-2 - 12 AT7 - AGC Amplifier and Control
V-3 - 12 AT7 - Blanking (limiter and clipper)
V-4 - 6L6 - Reactor Driver
V-5 - 6AS5 - Cathode Follower
V-6 - OA-2 - Negative Voltage Regulator

DIMENSIONS:
Height: 12" Depth: 8"
Width: 12 3/4" Weight: 24 lbs.

NOTE: This instrument is available on special order covering any frequency range from a minimum of 1.0 mc to a maximum of 220 mc with maximum sweep deviation of approximately 5 to 1.

level. The R.F. output can be varied over a 60 db range by a 20 db vernier potentiometer control and two 20 db step attenuators. The step attenuators offer a rapid coarse adjustment, while the A.G.C. control provides a vernier control of the output. The R.F. output circuit is matched to 75 ohms with a VSWR of less than *1.1* with or without the attenuators in the circuit.

Model 95

The Model 95 Generator delivers an R.F. output in excess to 1.5 volts across a 75 ohm load. This voltage is measured at the lowest part of the available output as a function of frequency. That is, this is the voltage to which the instrument must be set to obtain a flat R.F. output across the 22 mc to 95 mc band.

Model 220

The Model 220 Generator is capable of delivering an R.F. output in excess to 0.7 volts across a 75 ohm load. This voltage is also a measure of the lowest part of the available output as a function of frequency.

HORIZONTAL OUTPUT

Since a sweep generator, as the Model 95 and Model 220, is practically always used with an oscilloscope for the display of the characteristics being measured, it is convenient for the sweep generator to provide horizontal deflection voltage for the oscilloscope. This will assure that the display on the oscilloscope will stay in phase with the variations in frequency being displayed; the horizontal sweep of the oscilloscope becomes a true frequency reference for the graph being drawn. Both the 95 and 220 provide variable horizontal phasing through 180 degrees. For complete phasing of 360 degrees a phasing reverse switch is included on the panel.

BLANKING FEATURE

In many measurement procedures utilizing an oscilloscope, it is convenient if the measurement oscillator - Y axis to the oscilloscope - can be turned off periodically to establish the zero reference level for the circuit under analysis. Models 95 and 220 have internal blanking circuits which do this. This makes it possible to use the sweep generators for direct gain measurements of amplifiers over wide band widths.

DIAL ACCURACY

Recognizing the fact that the sweep generator is not, basically, a single frequency generator and therefore is not used as a frequency setting device, no attempt has been made to accurately calibrate the dials of these generators. The Bandwidth and Center Frequency dials are calibrated from 0 to 100. A chart enclosed on the front cover of the generators indicates the approximate calibration of the dials.

OUTPUT CONNECTORS

The R.F. and the Horizontal Output is extracted from the instruments through Jerrold Model F-61 type connectors which mate with the Jerrold "F-59" male cable connector. The Jerrold "F" series connectors are designed specifically for 75 ohm impedance applications where a minimum VSWR must be maintained.

POWER SUPPLY

The Power Supply is housed in the same cabinet with the generator and is connected to the sweep unit through an interconnecting cable. This cable is well shielded and by-passed from the R.F. circuitry.

To insure long "trouble-free" service, the power supply utilizes heavy duty selenium rectifiers in both its positive and negative voltage supplies. The negative supply is regulated by an 0A-2 gaseous, voltage regulator to insure stable operation of the generator

CABINET

The Model 95 and 220 Sweep Generators are housed in an attractive, portable aluminum case complete with convenient carrying handle. The finish is a durable baked on "Wrinkle" finish of government specifications. A hinged cover protects the front panel and knobs, and also contains the calibration chart. A small compartment has been included in the cabinet to house the line cord, an external detector and other accessories that may be used with the instrument.

RECOMMENDED ACCESSORIES

Attenuators

JERROLD Model A-72 - Variable attenuation 0. to 82 db.
JERROLD Model A-21 - Variable attenuation 0 to 21 db.

JERROLD variable attenuators, Model A-72 and Model A-21, offer precise attenuation by simple "IN" and "OUT" switches. The attenuators are designed for use with 75 ohm co-axial cable (RG-59/U type) and are linear over the range of frequencies form 0 to 250 MC and exhibit a VSWR of less than 1.05 when properly terminated. The accuracy of these attenuators is within ± 1.0 db at maximum attenuation. The insertion loss of the units is less than 0.5 db at 200 MC and they have a power handling capability of 500 milliwatts CW.

Detector

JERROLD Model D-85 - Split RF Detector.

The JERROLD Model D-85 detector is expressly designed for use with the Model 95 and the Model 220 Wide Band Sweep Generators. Its salient features include: Crystal Diode Voltage Doubling circuit-for maximum sensitivity; Split Type Detector circuit - making match measurements possible; Marker Input circuit - for the insertion of marker signals and Wide Range, Flat Frequency Response - ± 0.5 db from 5 to 250 MC.

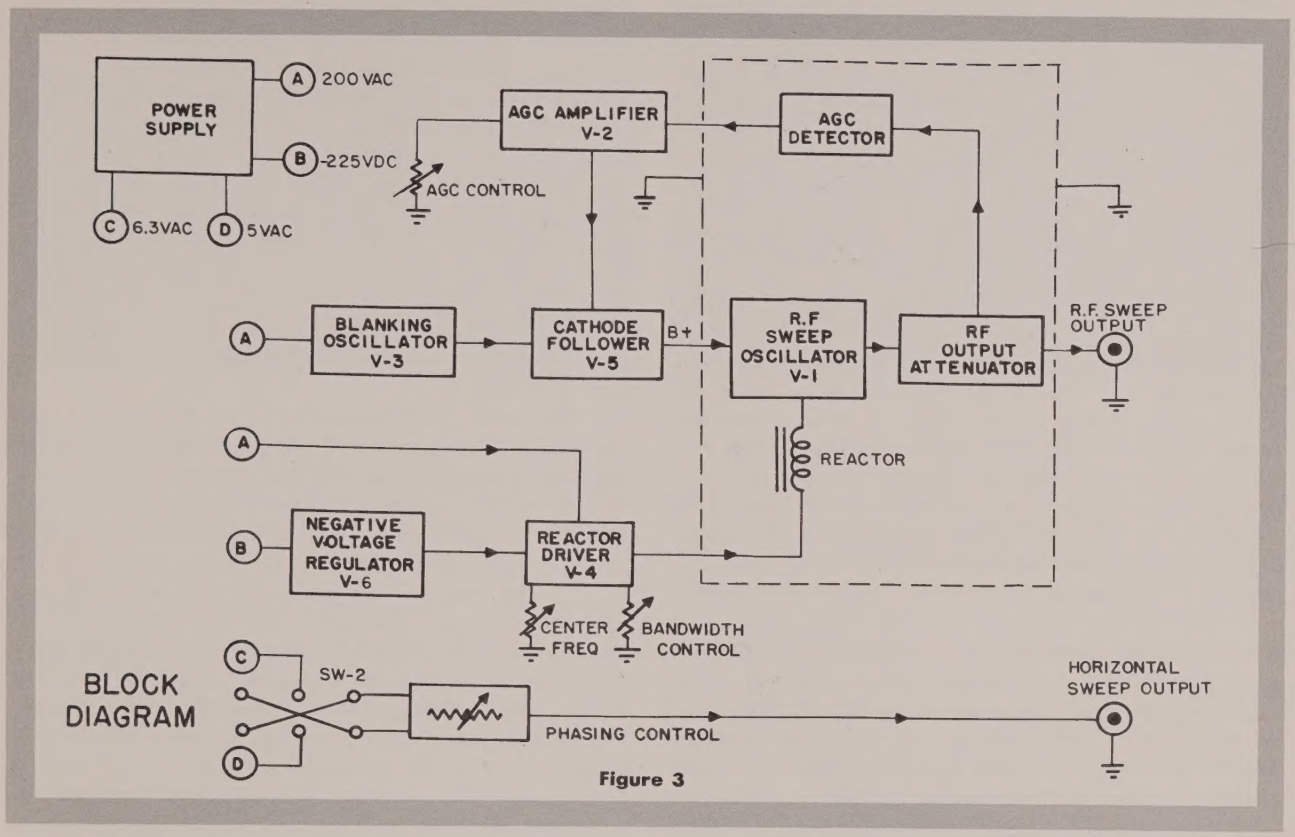


Figure 3

RADIO FREQUENCY OSCILLATOR

The radio frequency oscillator of each generator is a push-pull Hartley circuit using a 6CB8 dual triode oscillator tube. The tuned circuit of the oscillator consists of the center tapped coil L-1; which is wound on an iron core form of the cup-type design, the condensor C-3; used only in the Model 95 and the stray capacity of the oscillator tube V-1.

The frequency of the oscillator is determined by the value of C-3 in the Model 95 Generator. In the Model 220 Generator the frequency is determined by the value of L-1. The inductance of L-1 is varied by saturating its iron core. (This will be covered in detail under "The Sweep Circuit".) The designed operating frequency range of the Model 95 Generator is from 22 to 95 MC. In practice, the oscillator will tune from approximately 22 to 110 MC. The designed frequency range of the Model 220 is from 54 to 216 MC, and in practice this unit will also tune beyond this range; from 45 to approximately 225 mc.

B + for the oscillator tube (V-1) is developed across the cathode of the cathode follower V-5. The voltage is fed to the oscillator through isolation networks that contain a number of components. This circuit is designed to eliminate the possibility of any single component resonating in any portion of the oscillator's band.

The output of the oscillator is link coupled to a voltage measuring point, and to the output attenuator section. The "link" is of tight magnetic coupling which eliminates resonances between the output circuit and the oscillator.

The entire radio frequency circuit is included in a shielded compartment which is separate from the rest of the components in the generator. All leads attached to the shielded compartment are sufficiently by-passed with feed-through capacitors so as to virtually eliminate radiation from the compartment.

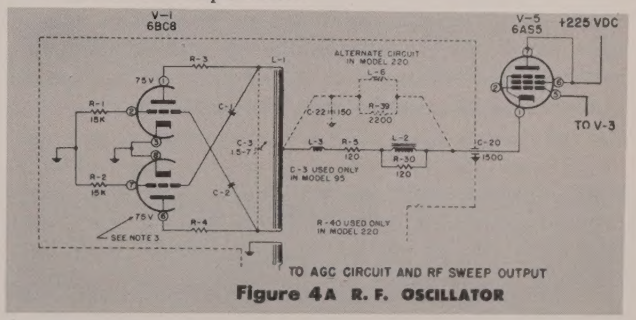


Figure 4A R. F. OSCILLATOR

SWEEP CIRCUIT

The output frequency of the sweep oscillator is controlled by the inductance of L-1. A magnetic flux passing

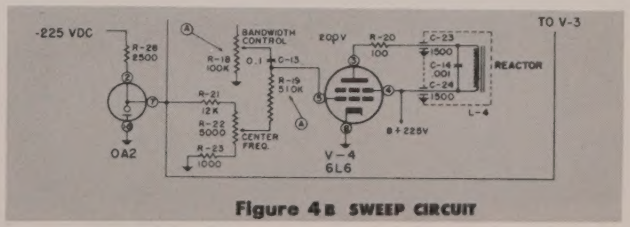


Figure 4B SWEEP CIRCUIT

through the core of L-1, establishes the inductance of this coil. When this magnetic flux is zero, the inductance of the coil is maximum and therefore the frequency of the oscillator is at its lowest possible value. When the magnetic flux through the core of L-1 is increased to its maximum density, the inductance of L-1 drops to its lowest possible value; some 25 times less than its maximum. At this inductance the oscillator operates at its highest possible frequency.

The magnetic field which saturates the core of L-1 is produced by the iron core magnet marked "reactor" in the plate circuit of the reactor driver.

The plate current flowing through the magnetizing coil of the reactor provides the magnetic flux which varies the inductance of L-1 and hence, varies the frequency of the oscillator. The frequency variation of the oscillator is controlled directly by the amount of plate current variation which, in turn, is determined by the a-c drive to the grid of the tube. The a-c driving voltage is provided from the high voltage secondary of the power transformer T-1. The driving voltage passes through a resistive dropping network a portion of which is the variable potentiometer R-18. R-18 is the front panel control labeled "Bandwidth Control".

The center frequency about which the oscillator is swept is controlled by the average or the d-c current through the reactor. This average current is a function of the d-c which is accomplished by applying a regulated negative voltage to the grid of V-4 through the variable potentiometer R-22. The negative voltage is well regulated to insure the maximum stability of the oscillator. R-22 is a front panel control labeled "Center Frequency Control".

AGC CONTROL CIRCUIT

As the frequency of the oscillator is swept back and forth through a desired band, there is a tendency for the output of the oscillator to vary in magnitude. This is caused by a number of circumstances, of which the variation in "Q" of the coil L-1 and the variation in coupling of the output loop are the most important.

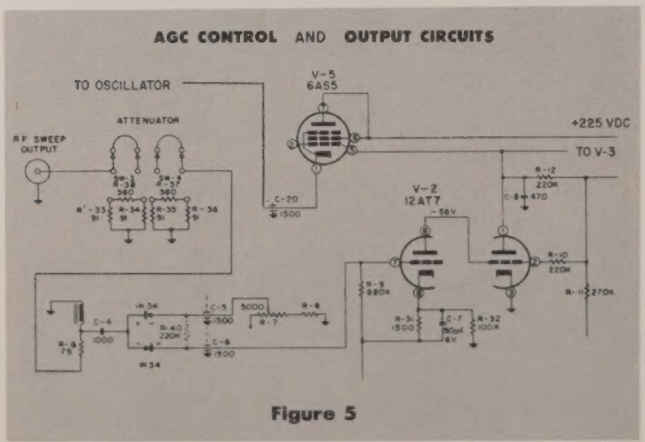


Figure 5

In a sweep generator used for the accurate test and alignment of critical equipment, it is desirable and necessary to have the output constant over the complete bandwidth. The Models 95 and 220 incorporate an output leveling - Automatic Gain Control - circuit to insure this.

The output voltage of the oscillator is linked coupled to the output attenuator circuit and to a voltage measuring circuit consisting of R-6 and C-4. The capacitor C-4, couples the R.F. energy to two type IN34 germanium diode crystals. The crystals are connected as a voltage doubler-rectifier to produce a d-c voltage, the amplitude of which is a measure of the R.F. voltage impressed on C-4. The d-c voltage is filtered and applied to V-2 which is connected as a two stage direct-coupled voltage amplifier, which inturn, is connected to the control grid of the cathod follower V-5.

The output of the cathode follower is the plate voltage supply for the oscillator. Initial adjustment of the d-c amplifier stages - V-2 - is achieved by a delayed bias control R-7 which is labeled as the "AGC Control", on the front panel of the instruments. The operation of the AGC control circuit is as follows:

Assume that the bandwidth of the sweeping oscillator is increased from a minimum value and that with this increase there is a tendency for the oscillator output to vary.

If we assume that the oscillator output increased then the d-c output of the measuring crystals also increases, but in a negative direction. This negative potential is applied to the first triode in the V-2 circuit. The result of the negative grid potential is that the plate increases in a positive direction applying this potential to the grid of the suceeding stage.

The positive potential on the grid of the second triode causes the plate to go in a negative direction. The plate of this stage is connected directly to the control grid of the cathode follower V-5. As the grid of V-5 goes negative it decreases the plate current of this stage. This reduction in plate current results in a reduction in the voltage dropped across this stage which is the B+ for the oscillator. A reduction in the oscillator's B+ results in a decrease in the R.F. output of the stage, thus counteracting the original tendency of the oscillator's output to increase.

Changes of the front panel AGC control, R-7, simply change the bias on the first AGC amplifier changing the average voltage around which the circuit operates. R-7 serves as a vernier control for the output of the sweep oscillator.

OUTPUT CIRCUIT

The AGC control (R-7) described in the preceding discussion, has a range of 20 db and is adequate for making fine adjustments in the R.F. output of the sweep generator. Since the sweep generator is capable of an output in the approximate vicinity of 1 volt, and since this output may be used in the alignment of sensitive equipment which does not require such high R.F. input levels, additional attenuation must be provided. Models 95 and 220 incorporate built-in attenuators comprised of two switch

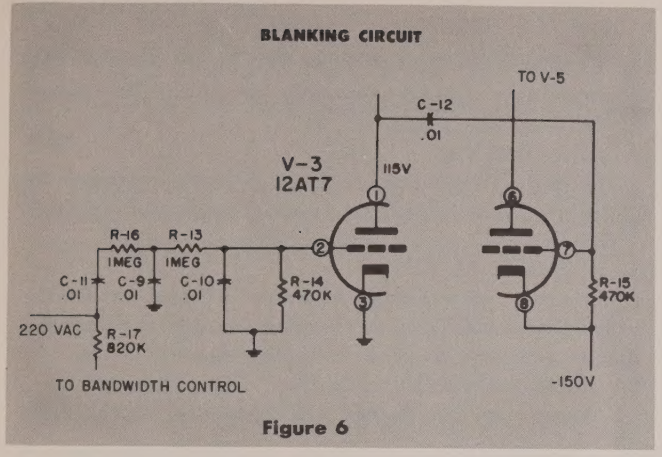


Figure 6

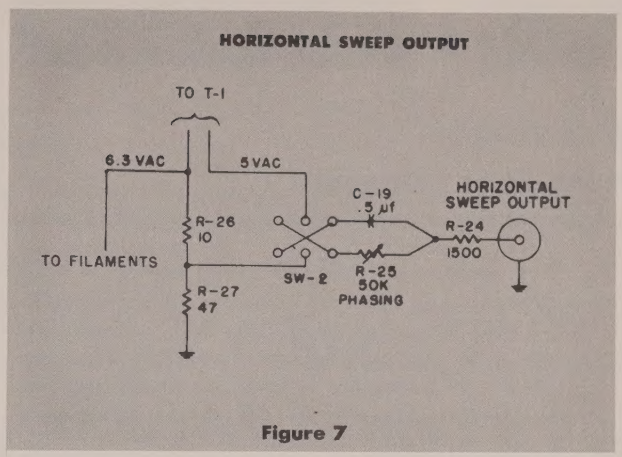


Figure 7

type sections, 20 db each. Either or both of the sections may be switched in to reduce the output level of the generator. Utilizing both the switch type attenuators and the variation possible with the AGC control, the level of the output may be set to any value within a range of 60 db below the maximum output.

The output impedance of the sweep generators is 75 ohms; that is to say, the generators display a characteristic impedance of 75 ohms looking back into their output terminals. Since the automatic gain control circuitry tends to keep the variation in output voltage at the junction of R-6 and C-4 to zero, then this point may be considered a zero impedance point. Connection, from this point to the output terminal is made through the 75 ohm resistor, R-6. A signal entering the generator through its output terminal looks into a 75 ohm resistor connected to a zero impedance, and hence, 75 ohms. The two 20 db attenuators also have a characteristic impedance of 75 ohms, and thus, their insertion into the output circuit leaves the impedance of the circuit unchanged. For measurement purposes, the generator looks into its output circuit as though it were a voltage source, constant within ± 0.5 db, connected to its output terminal through a resistor of 75 ohms. (Note. 50 ohm instruments available on special order).

BLANKING CIRCUIT

During certain measurements it is convenient if the Y-axis to the indicating oscilloscope is interrupted periodically. Interruption to the Y-axis establishes a zero reference level on the oscilloscope and makes equipment gain measurements possible. The blanking circuit of the Models 95 and 220 sweep generators performs this interruption automatically, and in the proper phase. The blanking is performed during the retrace cycle of the sweep generator.

Blanking is achieved through the use of a square wave generated by the blanking oscillator V-3. The square wave output of V-3 is applied to the cathode follower circuit to accomplish oscillator cut-off during the oscillator retrace cycle. An analysis follows: The driving voltage that is applied to the grid of the reactor driver is also applied to the blanking oscillator through a phase shifting network. The input circuit of the blanking oscillator is connected as a double limiter clipper circuit which generates a high amplitude wave with very steep slopes. This square wave is applied to the grid of the second triode of V-3. The cathode of this triode is connected to -150 volts d-c. This stage draws current when the positive half cycles of the square wave signals are applied to its grid. During conduction the impedance path between plate and cathode becomes very low and this effectively places the plate of this stage at -150 Volts. The plate is connected directly to the grid of the cathode follower V-5, biasing this stage at a -150 Volts. This, of course, completely cuts off the plate current of V-5 which eliminates the B+ to the oscillator and reduces its output to zero.

The phase shifting network in the grid of V-3 is necessary to assure that the blanking of the generator output will take place at the extreme high frequency excursion of the oscillator and will be removed at the extreme low frequency excurion of the oscillator.

HORIZONTAL SWEEP OUTPUT

When a sweep generator such as the type described here, is used for the analysis of equipment, it is practically always used in conjunction with an oscilloscope for the display of the characteristics being measured. If it is desired to have the oscilloscope display in phase with the variations in frequency of the sweep generator, the oscilloscope must be provided with horizontal deflection voltage whose phase is the same as the generator's. This is most conveniently accomplished by the generator itself. The Models 95 and 220 Generators provide a versatile horizontal sweep output. The horizontal sweep voltage is taken from windings on the transformer T-1, and is delivered to the output terminal through an R.C. network and a phasing reverse switch.

The phasing network consists of the variable phasing adjustment R-25 and the condenser C-19. The phase of the horizontal output may be continuously varied through a range of 180 degrees with the control R-25. To accomplish complete phasing of 360 degrees, the phasing switch, SW-2, may be used to reverse the phase. R-24 is a limiting resistor which limits the current in the horizontal sweep circuit and therefore protects the circuitry in case of a short at the oscilloscope terminals.

OPERATION

FUNCTION OF CONTROLS

The function of each front panel control is listed below:

1. BANDWIDTH
   Controls the width of the sweeping oscillator:
   Model 95 - Minimum of 2 MC to 73 MC maximum
   Model 220 - Minimum of 2 MC to 166 MC maximum
2. CENTER FREQUENCY
   Controls the mean or resting frequency about which the oscillator sweeps.
3. AGC CONTROL
   Controls the gain of the AGC amplifier and hence the output of the generator within a controlable range of 20 db.
4. HORIZONTAL PHASE.
   Controls and adjusts the phase between the driving voltage on the reactor, of the generator, and the horizontal drive voltage to the oscilloscope.
5. PHASE REVERSE
   Transposes the display left-to-right or right-to-left.

INITIAL TEST SET-UP

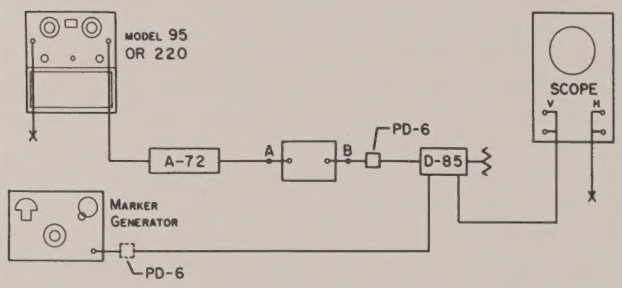


Figure 8

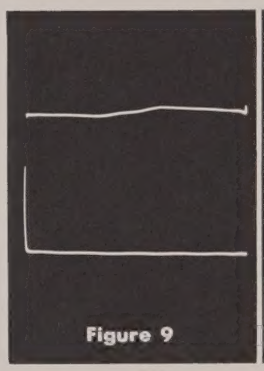


Figure 9

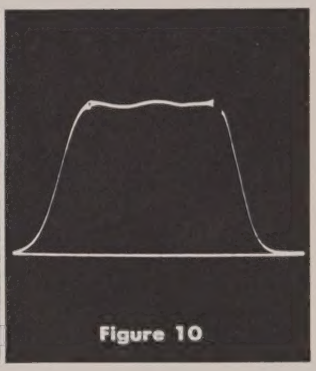


Figure 10

1. Connect the generator to a power source of 117 Volts, 60 cycle a-c. Allow the generator a warm-up period of at least five minutes.
2. Interconnect equipment as diagrammed in Figure 8 temporarily leaving out the unit to be tested. Connect points A and B together with a F-81 or equivalent. Use nominal 75 ohm coaxial cable with appropriate connectors for R.F. connections. The scope connections should be shielded.
3. Set the test oscilloscope for external horizontal sweep voltage.
4. Adjust *Bandwidth Control* to full bandwidth (fully clockwise) and *AGC Control* to maximum (fully clockwise).
5. Adjust scope controls for a full-size pattern centered on the screen. It may be necessary to add attenuation to the generator output. This may be done by the switch attenuators on the generators or by the external attenuator - JERROLD Model A-21 or A-72.
6. Adjust *Horizontal Phase Control* to phase the display properly.
7. Adjust *AGC Control* and note action of flattening out irregularities in response. Set this control to just flatten out peaks and valleys, but, as the output will decrease with too much AGC, it is desirable to use just the amount needed if maximum output voltage is desired from sweep generator. Refer to Figure 9.1.
8. Insert the unit to be tested at points A and B. It is important that the detector (Jerrold Model D-85) be preceded by a resistive match pad of at least 6 db attenuation. If the input of the unit under test, is other than 75 ohms, the generator should be connected through the attenuator (Jerrold Model A-72) through a dummy antenna or through a matching pad or network.

   If an amplifier is under test, sufficient attenuation should be inserted in the external attenuator (A-72) to prevent the amplifier from overloading. To test for overload, decrease the input signal 6 to 10 db; if the response shape changes, overload is present. If the unit under test is a passive circuit of high loss it may be necessary to follow the circuit with an amplifier whose band width is greater than that of the circuit under test. This will increase the level sufficiently for presentation on the scope.
9. Adjust *Center Frequency Control* to locate frequency spectrum of the unit to be tested. Set marker generator to establish desired markers on scope. If markers cannot be made strong enough it may be necessary to decrease the sweep generator output and increase the scope gain. Avoid overload with the marker signals.

   For the greatest accuracy in the alignment of television R.F. amplifiers it is recommended that "television air signal markers" be used in the marker input connector of the Jerrold Model D-85 Detector. It may be necessary to amplify the "air signal" markers before insertion at the detector.
10. Adjust *Bandwidth Control* to obtain desired presentation on oscilloscope. It may be necessary to re-adjust the *Center Frequency Control* slightly when changing from wide to very narrow bandwidths. *Figure 10* shows a typical amplifier response with markers.

APPLICATION

EQUIPMENT GAIN OR LOSS MEASUREMENT

Gain

1. To check the gain of an amplifier or similar equipment, connect the test set up in *Figure 8*, by-passing the unit under test with an F-81 (or equivalent).
2. Remove all attenuation from the variable external attenuator (A-72) and establish a convenient reference level on the oscilloscope. Example: 10 divisions.
3. Connect the unit under test at points A and B and insert attenuation in the A-72 until the preset reference is again established on the scope. The total attenuation in the A-72 represents the gain of the equipment.

Loss

1. The loss of the attenuators or passive networks may be established by connecting the circuits under test as in *Figure 8*.
2. With the scope gain set high, remove attenuation from the variable, external attenuator (A-72) and from the generator until a convenient reference is established on the scope.
3. Remove the circuit under test from the set-up and by-pass it with an F-81 (or equivalent).
4. Insert attenuation in the external attenuator (A-72) until the pre-set reference is established. The total attenuation in the A-72 represents the loss of the circuit.

SYSTEM SWEEPING

A community antenna system can be readily swept with either Model 95 or Model 220. The Model 95 Generator sweeps the entire Jerrold "W" and "K" range at one time (24-88). The Model 220 Generator sweeps the low and high VHF bands, channels 2 through 13, at one time (54 to 216 MC.)

The procedure in sweeping systems is to introduce the sweep at the head-end, being careful not to overload any amplifiers. The AGC must be deactivated on the system amplifiers by turning the switch on the power supplies to "Manual" or AGC "off". The technician may then proceed to any location further down the line and connect a detector and oscilloscope in the cable at that point to get a display of the response curves. For this display, it will be necessary either to use the internal saw-tooth sweep voltage in the scope, or, preferably, to use the 60 cycle a-c available, together with the suggested phasing network, Figure 11.

For complete systems displays, it is, of course, necessary to use maximum bandwidth on the sweep generator.

Channel response curves can be inspected individually at the oscilloscope position simply by advancing the horizontal gain of the oscilloscope.

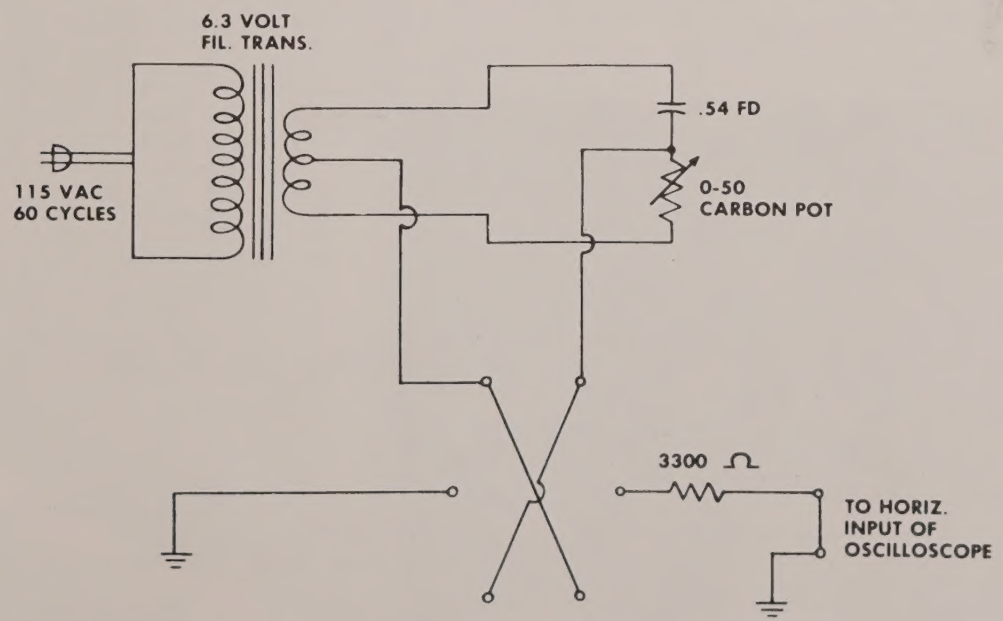


Figure 11

Section 3

The excellent match characteristics of the generators make these units especially suitable for VSWR measurements of 75 ohm devices. By using the "Delay Line" technique in the measurement procedure, excellent results are obtained.

A very effective "Delay Line" may easily be constructed from 150' of JEL-101 cable (Manufactured by Times Wire and Cable Co.) or any other *good* nominal 75 ohm, RG-11/U type cable.

1. Interconnect the equipment as shown in Figure 12.
2. With the delay line unterminated and O db attenuation in A-72, adjust the sweep generator output and oscilloscope vertical gain control for a convenient reference level (example: 10 divisions). Refer to Figure 13.

   Vertical gain control of the scope should be set to maximum gain for best results. A broadband amplifier may be required on some tests to obtain the required presentation. Make certain that the amplifier's response is flat and covers the band to be checked.
3. Terminate the end of delay line in 75 ohm resistor (TR-72F). Adjust sweep generator for maximum sweep over band of frequencies in question. An approximately flat response (Figure 14) should now be seen. Any slight irregularities resprest discontinuities in cable or/and connectors.
4. Remove TR-72F and connect the delay line to the unit under test. Count divisions on scope trace from maximum to minimum within desired band (example: 3 divisions). (Figure 15).
5. Remove test unit so standing wave pattern returns to 100% reflection (Step 1); introduce attenuation in A-72 until oscilloscope presentation is attenuated to level in Step 4. Read attenuation in the A-72 and refer to attached chart (Figure 16) for determination of VSWR.
6. Example: A-72 reads 8 DB; from chart, VSWR = 1.4. Observe that reflections are attenuated by an amount twice the setting on the A-72. Thus, for 8 db of attenuation in A-72, reflections are attenuated 16 db, or are 16 db down from the open circuited condition. 16 db.= 6.3:1 - 100% / 6.3 = 16% reflection.

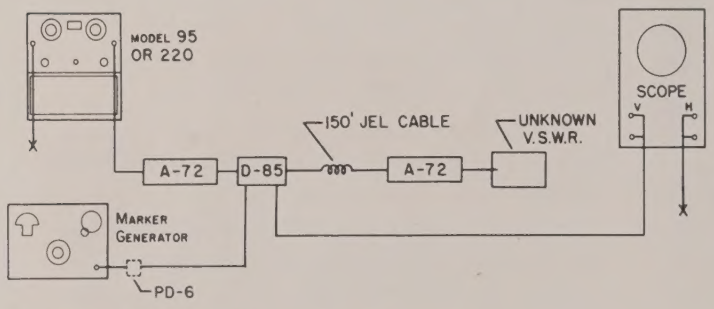


Figure 12

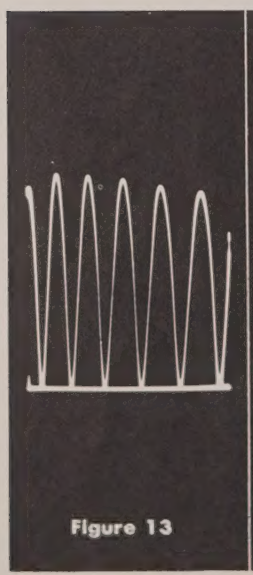


Figure 13

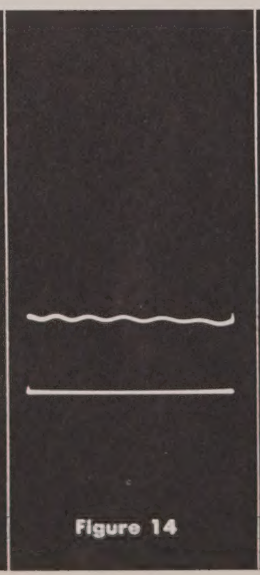


Figure 14

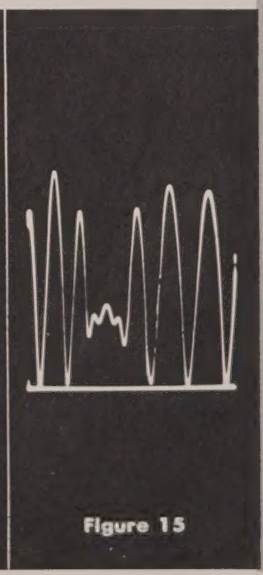


Figure 15

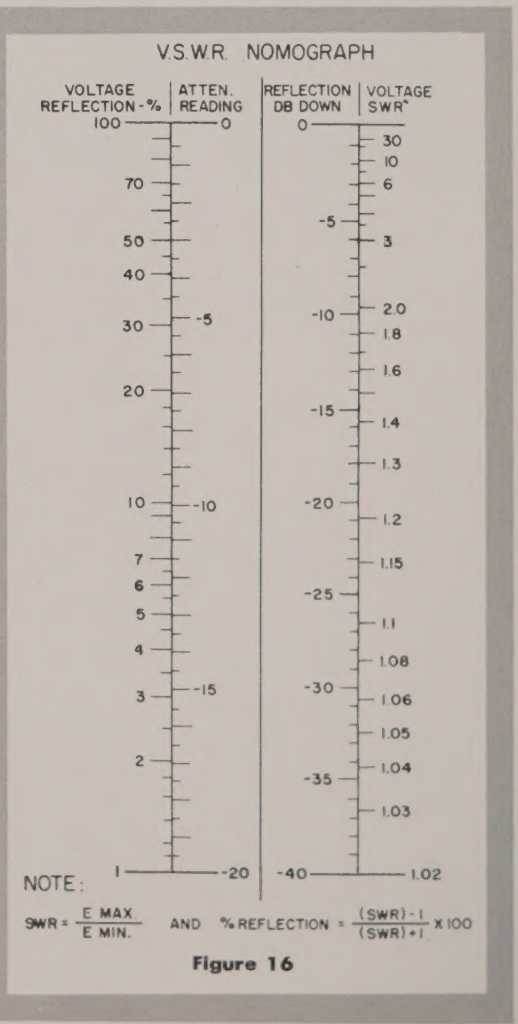

V.S.W.R. NOMOGRAPH
VOLTAGE REFLECTION - %
ATTEN. READING
REFLECTION DB DOWN
VOLTAGE SWR
NOTE:
SWR = E MAX / E MIN. AND % REFLECTION = (SWR) - 1 / (SWR) + 1 X 100

Figure 16

ANOTHER WIDE BAND SWEEP GENERATOR WITH UNUSUAL CHARACTERISTICS

Model 900 — Ideal for the Laboratory or Production Test

Features:

- Complete voltage regulation
- Rugged mechanical design
- Precision parts
- Provisions for external markers
- Built-in oscilloscope preamplifier
- Built-in detector
- Built-in filters

Description:

The JERROLD Model 900, Wide Band Sweep Frequency Generator is an instrument of unusual versatility. In two ranges — "VHF" and "UHF" — the instrument supplies a sweep signal with center at any frequency from 200 KC to over 1,000 MC and with sweep widths as broad as 300 MC and as narrow as 100 KC. The RF output — carefully monitored by matched, crystal diodes feeding a two-stage AGC amplifier — is flat within ± 0.5 db over the entire VHF range; 200 KC to 250 MC. At a maximum sweep width of 300 MC, the total RF output variation of the UHF range — 250 MC to 1,000 MC — is less than ± 3 db. The mechanical and electrical stability and the extreme constancy of its output recommend the Model 900 Generator for use wherever careful and highly accurate sweep frequency measurements are to be made.

For additional information write for Manual #1900

Specifications:

Center Frequency: VHF Range—0.2 MC to 250 MC. UHF Range—250 MC to 1,000 MC.

Sweep Width: VHF Range—0.1 MC to 250 MC. UHF Range—0.1 MC minimum to maximum of 100 MC at 275 MC center. 300 MC maximum at 1,000 MC center.

Output Voltage: 0.3 V. rms into 75 Ohm Load.

Source Impedance: 75 Ohms, with VSWR less than 1.2 (50' Ohms available on special order).

Output Voltage Variation; Total Variation at Maximum Sweep: VHF Range— ± ½ db. UHF Range— ± 3 db.

Beats and Harmonics: 20 db or more below the fundamental output at all frequencies.

Signal Radiated: Oscillators are doubly shielded and all supply leads carefully filtered to keep radiation at an absolute minimum.

Built-In Scope Preamplifier: Gain of 100X. Allows displaying response of passive networks with loss as great as 40 db. Hi-pass connection provided for delay line applications.

Linearity of Frequency Scale (in Relation to H. Deflection Voltage): Within 5% of sweep width.

Frequency Modulation: 60 Cycle Sinusoidal.

Horizontal Deflection Voltage: 1 Volt peak to peak into load of 100,000 ohms or higher.

Marker Injection Circuits: Provide for injection of two frequency markers at any frequency within range of sweep with built-in amplifier and amplitude control.

Power Supply Requirement: 100 to 130 V rms at 60 cycles, 75 watts. (Built-in Sola regulating transformer provides stable performance for any line voltage within this range.)

Fuse: ⅛ Amps.

Tube Complement

Type	Function
OD-3	Voltage Regulator
OD-3	Voltage Regulator
12AT7	Marker Amplifier
12AT7	Scope Preamplifier
12AT7	AGC Voltage Amplifier
6 Y6G	AGC Output Amplifier
12AT7	Blanking Amplifier
5675	Sweep Oscillator
6R4	Fixed Oscillator
K3A	Silicon Diodes

V1	
V2	
V3	
V4	
V5	
V6	
V7	
V8	
V9	
X-1 to X-9 Inc.	

Mechanical:

Cabinet: 10½", high, 23" wide, 15½" deep. May mount on its standard 8¾" relay rack panel with cabinet omitted.

Weight: 63 lbs.

JERROLD

JERROLD...

THE FOREMOST MANUFACTURER, SUPPLIER AND INSTALLER OF RF TELEVISION DISTRIBUTION EQUIPMENT AND SYSTEMS.

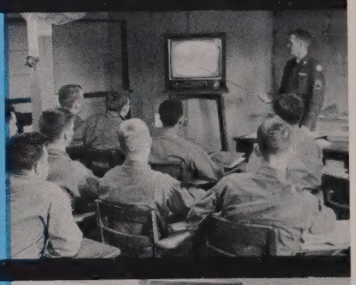
Jerrold has found it necessary to design and manufacture, for its own use, many types of test equipment and other specialized components, not available on the commercial market. This necessity has led to the development and production of unusual equipment and accessories that have great benefit for the electronics industry.

Jerrold's advanced leadership and experience in the field of RF signal transportation and distribution is of valuable assistance in the office, plant, laboratory and in the field.

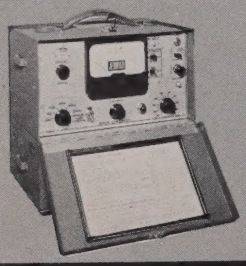
A few of the diversified applications for Jerrold Equipment and Services are listed below:

Television Systems

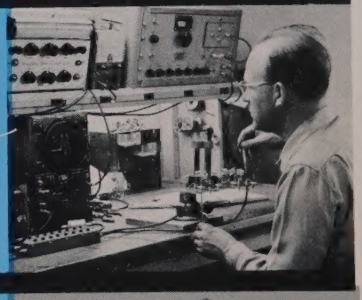
Utilizing FM modulation and demodulation equipment, Jerrold's exclusive single cable tone-controlled transmission system permits extreme accuracy in closed circuit television, data transmission, remote control and all phases of RF and video distribution over great distances.



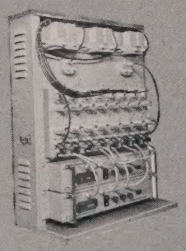
Instrumentation



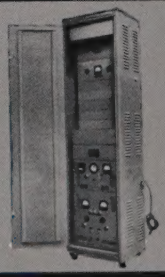
The use of Jerrold wide-band sweep frequency generators, field strength meters, oscilliscope preamplifiers, electronic coaxial switching devices, RF attenuators and other test accessories permits more accurate laboratory measurements, improved production tests and field surveys.



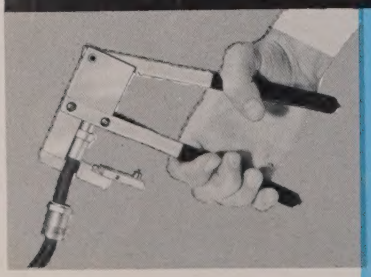
Communications



Parabolic and other special high-gain, directive television antennas, television transmitters, AM amplifiers, regulated power supplies and a complete line of RF amplifying and distribution equipment for the ultimate in master and community antenna systems.



Engineered Accessories



Assure low VSWR RF transmission through the use of Jerrold custom designed low-loss, long-life coaxial cable and a complete line of solderless 75 ohm coaxial connectors and fittings. Designed for use with military, commercial and all electronic apparatus.

Jerrold maintains a nation-wide organization of trained sales and field engineers. This experienced staff is always ready to plan, supply or install the equipment or system best suited to your individual needs. Call, wire or write for the name of the Jerrold office nearest you.

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4M December 1956

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